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Title
Design aspects of **superconducting-phase** quantum bits.

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Abstract
A **superconducting-phase** quantum bit **(qubit)** involves three or more Josephson junctions combined into a **superconducting loop** and defines one of the promising solid-state device implementations for quantum computing. Recently, so called pi junctions, Josephson junctions with a ground state characterized by a pi **-phase shift** across, have attracted much attention. We show how to make use of such pi junctions in the construction of **superconducting phase** qubits and discuss the advantage over conventional designs based on magnetically frustrated loops. Starting from a basic five-junction **lo p** with one pi junction, we show how to construct effective junctions with degenerate minima characterized by **phase** shifts 0 and pi and **superconducting-phase** switches. These elements are then combined into a **superconducting- phase qubit** which operates exclusively with switches, thus avoiding permanent contact with the environment through external biasing. The resulting **superconducting-phase** qubits can be understood as the macroscopic analog of the "quiet" s-wave-d-wave-s-wave Josephson-junction qubits introduced by Ioffe et al. Nature (London) 398, 679 (1999)ù. (36 refs).

Descriptors
quantum-computing; superconducting-junction-devices.
Keywords
design aspects; **superconducting phase** quantum bits; **qubit;** Josephson junctions; **superconducting lo p;** quantum computing; pi junctions; ground state; pi **phase shift; superconducting phase** switches; external biasing.
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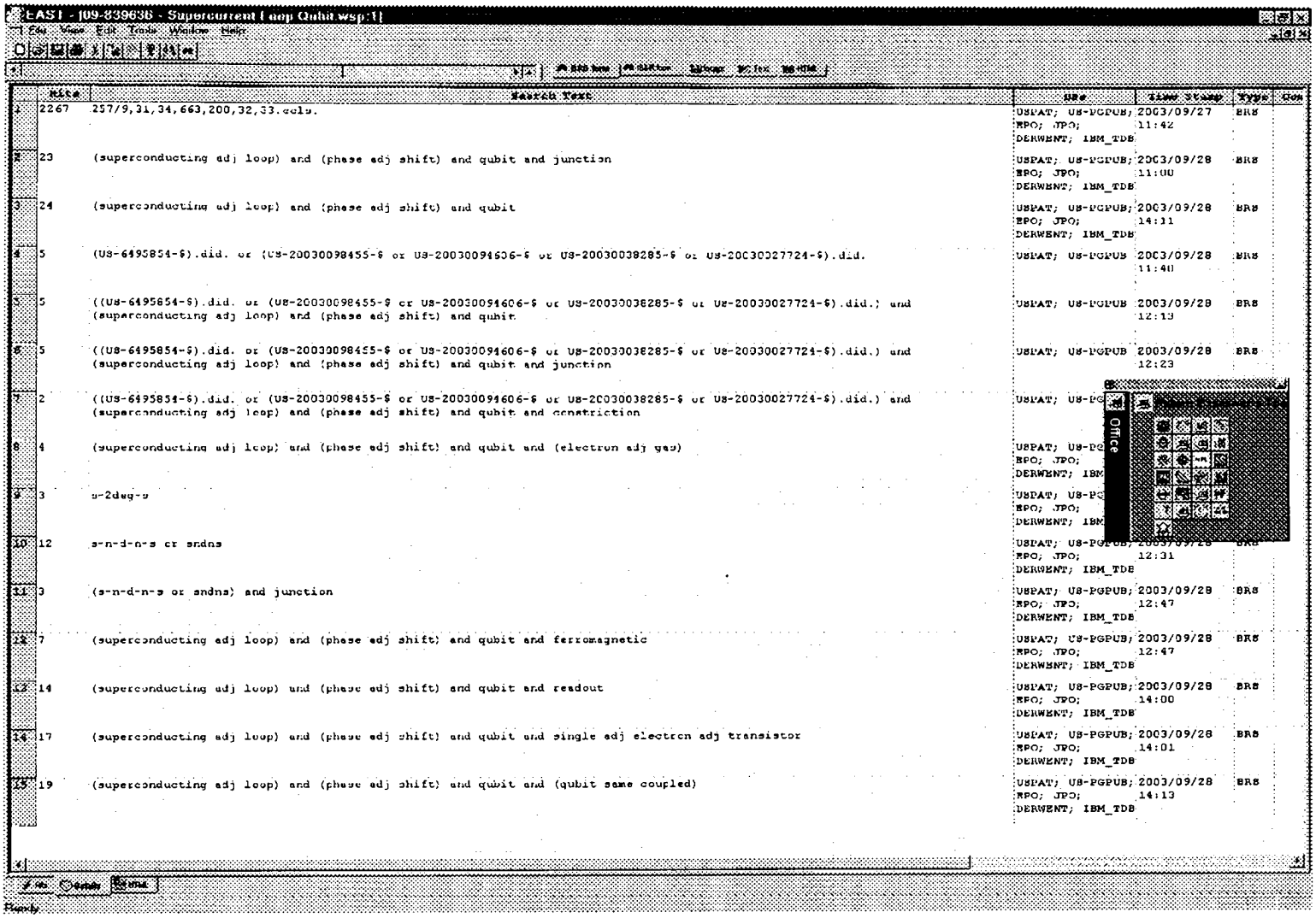

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14	17	(superconducting adj loop) and (phase adj shift) and qubit and single adj electron adj transistor	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/09/28 14:01	BRS	
15	19	(superconducting adj loop) and (phase adj shift) and qubit and (qubit same coupled)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/09/28 14:13	BRS	

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